

Claims

1. A method for measuring the injection rate of an injection valve for liquids, preferably for liquid fuel, in which the injection valve (3) injects the liquid into a liquid-filled measurement volume (1), the measurement volume (1) being closed off on all sides and a pressure sensor (20) being located in the measurement volume (1), characterized by the following method steps:

- injecting liquid by the injection valve (3) into the measurement volume (1);
- measuring the pressure ($p(t)$) in the measurement volume (1) by means of the pressure sensor (20) during the injection, and recording of these measured values;
- determining the speed of sound (c) in the measurement volume (1);
- determining the injected test liquid quantity ($m(t)$; Δm) from the measured pressure values ($p(t)$) and the speed of sound (c).

2. The method according to claim 1, characterized in that the measured pressure values ($p(t)$) are recorded by an electronic computer (28) during the injection.

3. The method according to claim 1, characterized in that the speed of sound (c) is determined by means of a separate measurement method.

4. The method according to claim 3, characterized in that the speed of sound is calculated from the transit time of a sound signal traveling from a sound transducer (21) to a sound receiver (20; 30).

5. The method according to claim 1, characterized in that the speed of sound (c) is determined from the natural frequencies (v_n) of the measurement volume (1).
6. The method according to claim 5, characterized in that the natural frequencies (v_n) are determined by a frequency analysis of the measured pressure values ($p(t)$).
7. The method according to claim 6, characterized in that the measured pressure values ($p(t)$) are filtered with a low-pass filter.
8. The method according to claim 7, characterized in that from the course of the measured pressure values ($p(t)$), a variable proportional to the injection rate ($r(t)$) is calculated by chronological differentiation.
9. An apparatus for measuring the injection rate ($r(t)$) of an injection valve (3) for liquids, having a measurement volume (1) which is closed off on all sides and is filled with a test liquid, having an opening (10) in the wall (2) of the measurement volume (1) for receiving an injection valve (3), so that the injection valve (3) in the installed position protrudes with at least one injection opening (12) into the measurement volume (1), and having a pressure sensor (20) which is located in the measurement volume (1), characterized in that the pressure sensor (20) is disposed in the pressure node of the first natural pressure oscillation of the measurement volume (1).
10. The apparatus according to claim 9, characterized in that the measurement volume (1) is embodied cylindrically.
11. The apparatus according to claim 10, characterized in that the pressure sensor (20) is located in the radial plane that is located centrally between the two bases (102; 202) of the cylinder.

12. The apparatus according to claim 9, characterized in that an electronic computer (28) detects the measured values of the pressure sensor (20) and stores them in memory.

13. The apparatus according to claim 12, characterized in that a program that calculates the natural frequencies of the measurement volume (V) from the recorded measured pressure values ($p(t)$) runs on the electronic computer (28).

14. The apparatus according to claim 9, characterized in that a sound transducer (21) and a separate sound receiver (30) are located in the measurement volume (V).